A (POCKET) GUIDE TO THE LOWER STRETCH OF THE SÂO FRANCISCO RIVER - BRAZIL

BUILDING A COLLABORATIVE PROJECT TO MAP PEOPLE IN SITUATIONS OF SOCIO-ENVIRONMENTAL INJUSTICE

CANOA DE TOLDA
INFOSÃOFRANCISCO

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BUILDING A COLLABORATIVE PROJECT TO MAP PEOPLE IN SITUATIONS OF SOCIO-ENVIRONMENTAL INJUSTICE

SOME INFORMATION/DATA ON TERRITORY/WATER
USE AND CONTROL, FLOW MONITORING,
FLOOD PREVENTION, POPULATIONS

A PROJECT BY

CANOA DE TOLDA INFOSÃOFRANCISCO

support

MAPSÃOFRANCISCO

Baixo São Francisco – Feb 2022

Cabeço island – in the mouth. Foto: Daia Fausto/Canoa de Tolda

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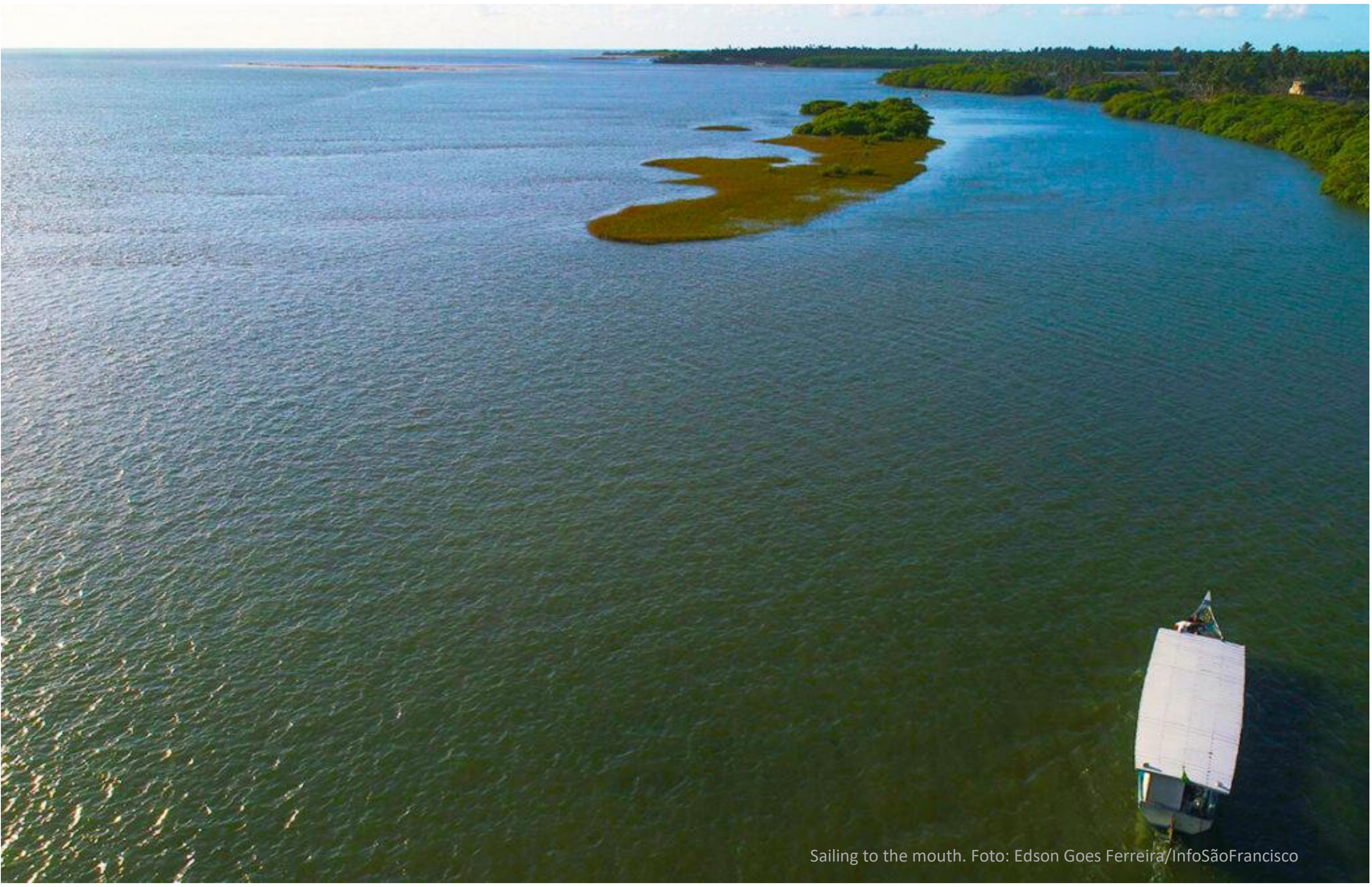
1. JUST A FEW WORDS BEFORE YOU START READING…

This small *pocket guide* has one simple intention: provide and organize general information on the socio-environmental panorama of the **BSF – Baixo São Francisco** (the lower stretch of the São Francisco river basin) for potential partners and the general public interested in collaborative initiatives prioritizing situations of humanitarian injustice, and citizen empowerment and monitoring of territory, biodiversity with relevance in situations related to water.

As it is an evolving document, the guide may be updated, always with the aim of improving the information and data available, as well as facilitating access to anyone.

Feel free and invited to express observations, constructive criticism, in order to add more information and data.

The guide is public, collective, and can be disseminated, published simply by citing the sources.



Sailing to the mouth. Foto: Edson Goes Ferreira/InfoSãoFrancisco

2. THE SÃO FRANCISCO RIVER: ITS REGION, ITS PLACES

A brief, overall view on the São Francisco river basin, physiographic regions, evolution milestones of anthropic interventions, main conflicts.

2.1. THE SÃO FRANCISCO RIVER BASIN

The São Francisco river basin covers 639,219 km2 of drainage area (7.5% of the country) and an average flow of 2,850 m3/s (2% of the country's total). The São Francisco River is 2,700 km long and rises in the Serra (mountain range) da Canastra in the states Minas Gerais, flowing in a south-north direction through states of Bahia and Pernambuco, when it changes its course to the east, reaching the Atlantic Ocean through the border between the states of Alagoas and Sergipe.

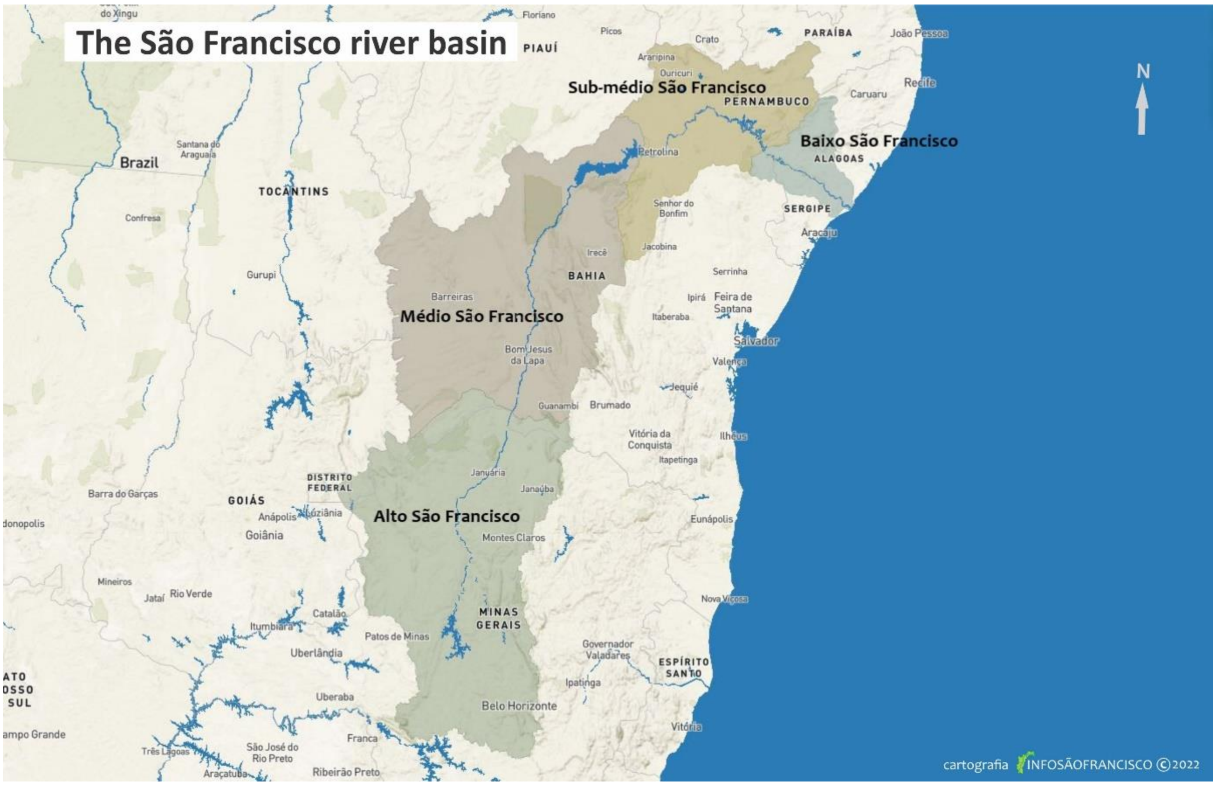


Figure 1- Source: ANA

The São Francisco river basin has part of territory of seven federation units - Bahia (48.2%), Minas Gerais (36.8%), Pernambuco (10.9%), Alagoas (2.2%), Sergipe (1.2%), Goiás (0.5%), and the Federal District (0.2%) – and 505 municipalities (about 9% of the total number of municipalities in the country.

For water and territory management, the São Francisco river basin is organized in four regions: the upper stretch; the middle stretch; the sub-middle stretch and the lower stretch, our area of interest

2.2. MAIN USES OF WATER

Regarding uses, there is a predominance of withdrawal for irrigation (213.7 m³/s), which represents 77% of the total demands in the Region. Irrigation is followed by urban demand, with 31.3 m³/s (11%), concentrated mainly in the Metropolitan Region of Belo Horizonte, and industrial demand with 19.8 m³/s (7%). The animal demand in the region is 10.2 m³/s (4%) and the rural demand is 3.7 m³/s (1%).

The São Francisco Region plays an important role in the generation of electricity, with an installed potential of 10,708 MW in 2013 (12% of the country's total).

The plants in Xingó (3,162 MW), Paulo Afonso IV (2,462 MW), Luiz Gonzaga (1,479 MW) and Sobradinho (1,050 MW) stand out. The hydroelectric use of the São Francisco River represents the energy supply base of the Northeast of the country.

2.3. DAMS, WATER CONTROL, END OF NATURAL CYCLES

Old reports (and more recent ones, before the great dams construction) and data registered that during the natural floods season (October/November to February/March) the São Francisco waters advanced about 30 km inside the Atlantic Ocean.

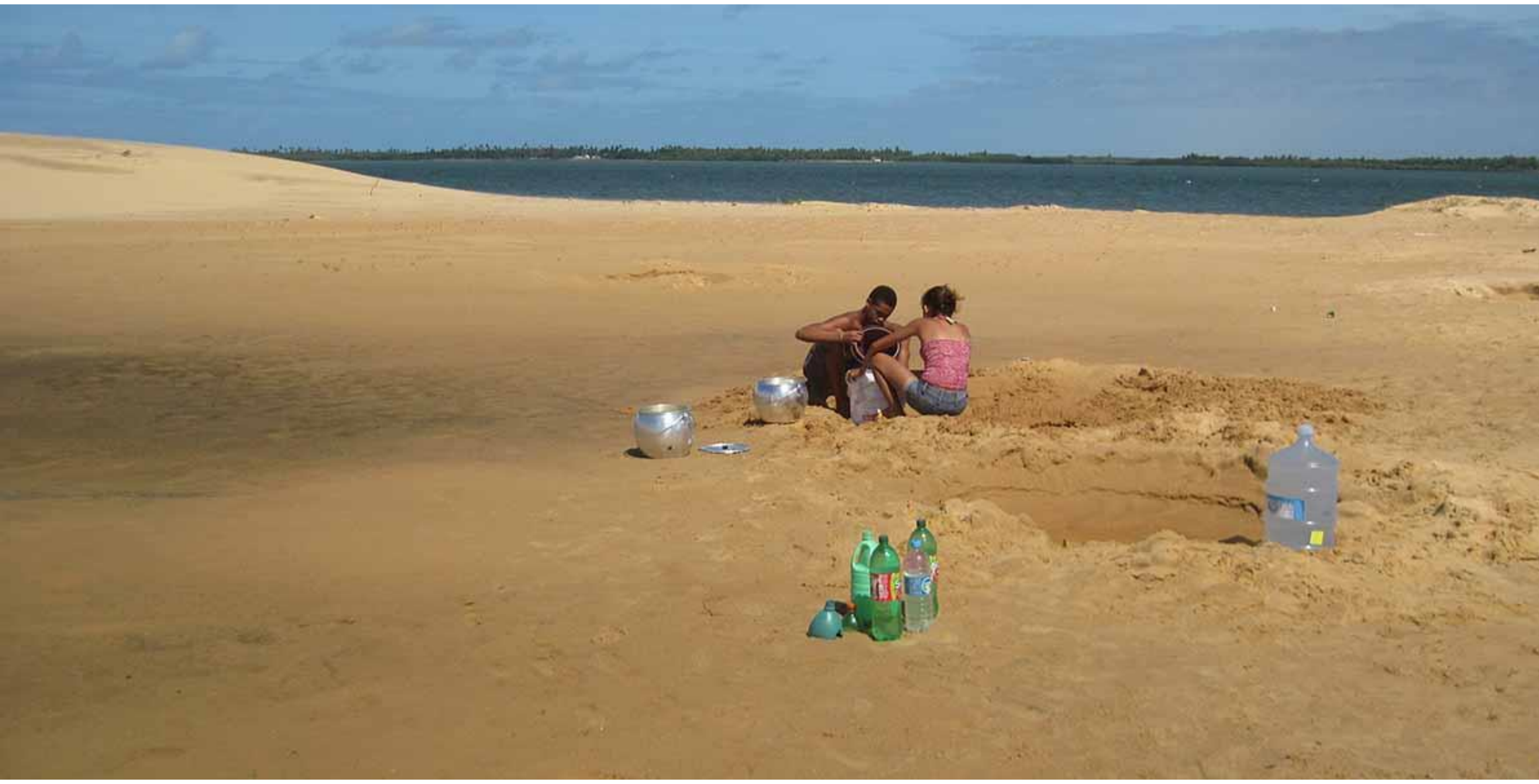


Figure 2 - At the mouth of the river, the search for water for human use. Photo: Carlos E. Ribeiro Jr./InfoSãoFrancisco

Currently, the waters of the Atlantic Ocean advance inside the river about 16 km, according to the allowed flow from the dams and the tides, salinizing the river waters and preventing a huge population from having access to drinking water.

At the same time, the coast to the south of the mouth, without the input of sediments, is undergoing an accelerated retreat: villages have already been destroyed by the advance of the sea forcing the relocation of populations in other places

The construction of large dams on the São Francisco River began in the 1950s, initially with the first hydroelectric dams at the Paulo Afonso complex (four dams), in Bahia.

The Xingó dam was the last one, in 1994. However, in 2021, the prospect of yet another large dam in Minas Gerais emerged, downstream of the Três Marias dam.

With the construction of Sobradinho dam (1979/80), the natural floods in the Lower São Francisco were eliminated, promoting the drying up of the intermitent marginal lakes that, with less water, are now invaded and irregularly occupied territory.

The average flow with the construction of the Sobradinho dam (1979/80) was up to 2.060 m³/s (two thousand and sixty cubic meters per second).

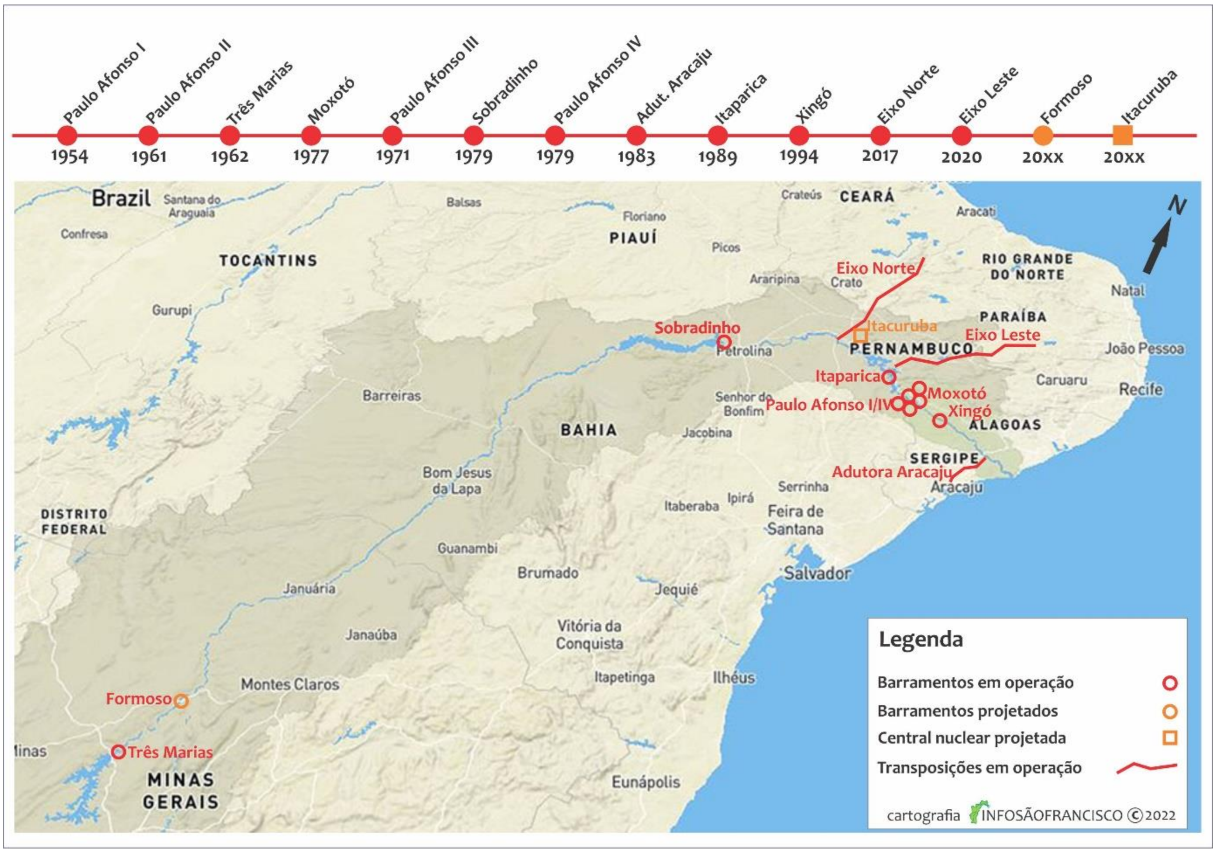


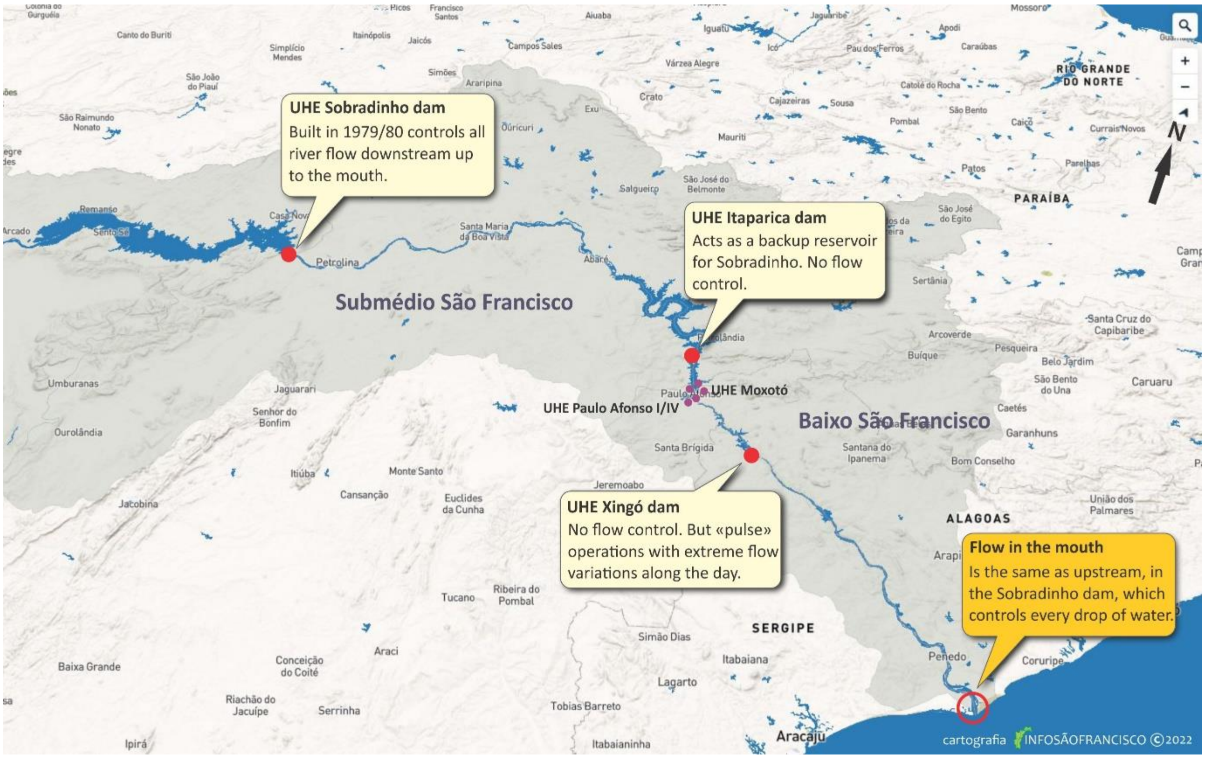
Figure 3 – Most recent anthropic structures with direct impacts on river flow in the São Francisco river basin. Notes: Itacuruba (nuclear plant project); Formoso (dam project); Eixo Norte and Eixo Leste (São Francisco river diversions). Source: ANA/MDR/CHESF

The Três Marias dam controls all the regularized flow upstream of Sobradinho, which, in turn, with the support of Itaparica, controls every drop of water that reaches the ocean.

Sobradinho dam, in Bahia and Pernambuco border, sub-middle stretch (regulating and power generating dam).

Itaparica dam, in Pernambuco, sub-middle stretch (regulating and power generating dam).

Xingó dam, in the border of Alagoas and Sergipe, lower stretch (run-of-river power gernerating dam), has a very extremely impactful operational model, with hourly flow variations throughout the day, causing tides, accelerating the erosive process and also the silting of the river bed. During weekends, flows are even lower than the weekly average.



UHE Sobradinho dam
Built in 1979/80 controls all river flow downstream up to the mouth.

UHE Itaparica dam
Acts as a backup reservoir for Sobradinho. No flow control.

UHE Xingó dam
No flow control. But «pulse» operations with extreme flow variations along the day.

Flow in the mouth
Is the same as upstream, in the Sobradinho dam, which controls every drop of water.

Figure 4 - The river flow control by the Sobradinho dam. Source: ANA/CHESF

From the event of the great floods of 1980, when it became evident the impossibility of controlling them by the Sobradinho dam, the first flow restrictions were created for the sub-medium and low sections. The restriction flows were, until 2016:

Maximum – 8.000 m³/s (the reference flood) – still valid.

Minimum – 1.300 m³/s. Not anymore. In 2016 the basin comitee suppressed the value of the watershed management plan, and the flow was reduced to 700 m³/s by resolution of the water federal agency (ANA) and in the Xingó dam operating license by the federal bureau IBAMA.

The 700 m³/s was the electrical sector main target since many years ago. The Canoa de Tolda organization promoted a series of complaints over the years, but society did not arouse any interest and allowed the electric sector to consolidate its total dominion over the waters of the river.

2.4. WATER MANAGEMENT

As it passes through several states of the federation, the São Francisco river is a federal domain river. However, tributaries that flow through only one state are bound by state legislation regulations.

This is a relevant situation in order to understand the difficulty of obtaining agreements on water management and how, in fact, with what flow, the São Francisco should reach the sea.

The main bodies in the **SINGREH – Sistema Nacional de Gerenciamento de Recursos Hídricos** (the national water resources management system) which manages (directly and/or indirectly) the São Francisco river waters are:

ANA – Agência Nacional de Águas e Saneamento Básico – the federal water agency has control over the regulation, however, as it is a river completely barred to the production of energy, in fact, the electricity sector is in total control of the flows.

ONS - Operador Nacional do Sistema - The control of water by the electricity sector takes place through through the **ONS – Operador Nacional do Sistema** (an unbelievable non-governmental organization of the federal government itself).) which operates water stocks, energy production and its distribution through the huge national interconnected system - which is guaranteed by a legal and regulatory system that does not effectively contemplate the environment.

CHESF – Companhia Hidro Elétrica do São Francisco – operates all other 8 dams (the Sobradinho dam completely regulates the flows to the mouth since 1979/80), in the sub-middle and lower stretches.

CEMIG – Companhia Energética de Minas Gerais – operates the Três Marias and Queimado dams, in Minas Gerais, upper stretch.

IBAMA – Instituto Brasileiro do Meio Ambiente e do Recursos Naturais Renováveis - the federal environmental licensing agency.

CBHSF – Comitê da Bacia Hidrográfica do Rio São Francisco – The river basin committee, which in fact fails to meet the wishes of the populations and which has disproportionate participation of civil society (25,8%) vis-à-vis user segments (38,7% - agribusiness, mining, electricity sector, etc.) and public agents/governments (32,2% - federal, states and municipalities), traditional communities have only 3,3%. The committee is responsible for preparing the **basin management plan** from which**, in 2016, it removed the minimum flow of 1.300 m³/s**.

However, there is a situation that must be understood clearly: as in other rivers where power generation dams are installed, the regulatory system also gives the electricity sector primacy in the management of its waters on the São Francisco river.

2.5. THE NATIONAL INTEGRATED ELECTRICITY TRANSMITION SYSTEM

Brazil has a huge integrated electrical system, which makes it possible for energy generation in a given location to be conducted to distant locations where demand occurs.

Thus, the ONS, the federal agency that operates the system, thanks to a series of regulatory devices that guarantee the electrical system the management of rivers with energy-generating dams and its reservoirs, has in its hands the absolute control of the waters of such rivers as the São Francisco.

So, for the electrical segment, water is only considered the "fuel" for hydroelectric plants, a priority use, imposing a management that generates endless conflicts.

Even the federal water agency does not see the São Francisco River as a river, an entity essential for life, but a "system" that is represented as something similar to a residential plumbing installation.

A vision that clearly does not contribute to a way of resolving conflicts over the use of water.

Water management is guided by the basic premise of "water security guarantee", that is, water stock for energy generation (where social and environmental impacts and liabilities are not a priority).

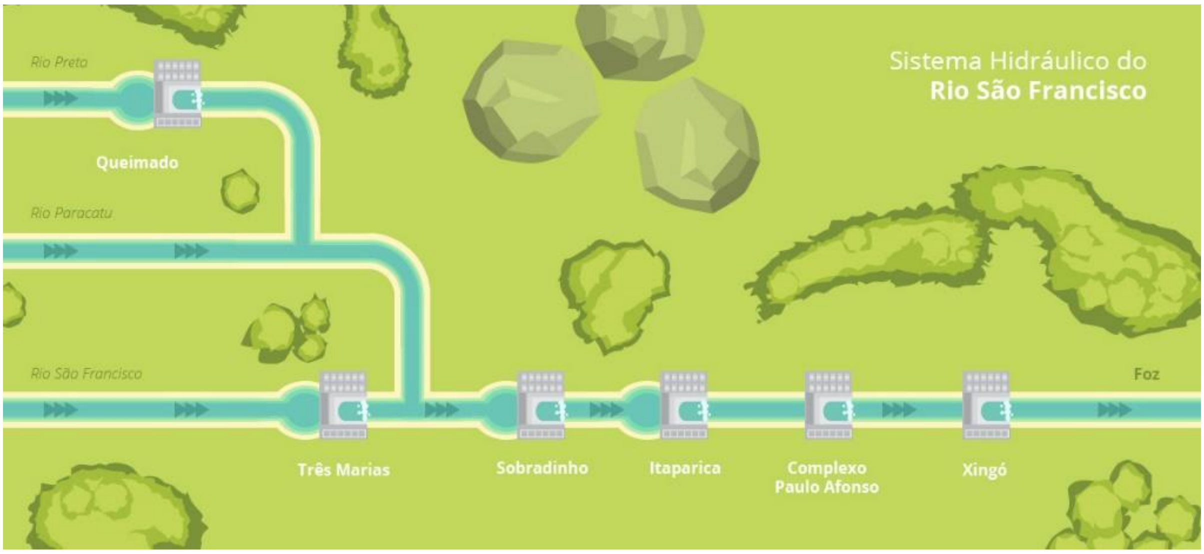


Figure 5 - The São Francisco river as seen by the water management system. Source: ANA

2.6. DATA SOURCES, DATA, INFORMATION ACCESS

Despite a large amount of data available, their availability is confusing, there is redundancy of the same information in sites of different sectors (electricity, water agency, dam operators, etc) and availability of difficult (of a not friendly, easy) access for people without knowledge of the systems.

Data such as the tributary and effluent flows of the dams, in several other points of the rivers, their levels, are, significantly, generated and published by the electric sector and/or by the water agency.

For the purposes of this guide, the main data sources are used and will be listed:

ANA – Federal water agency

CPRM - Federal geological service agency ( )

ONS - National electrical system operator

CHESF – main dams operator in the São Francisco river (8 dams)

CEMIG – upper stretch dam operator (2 dams)

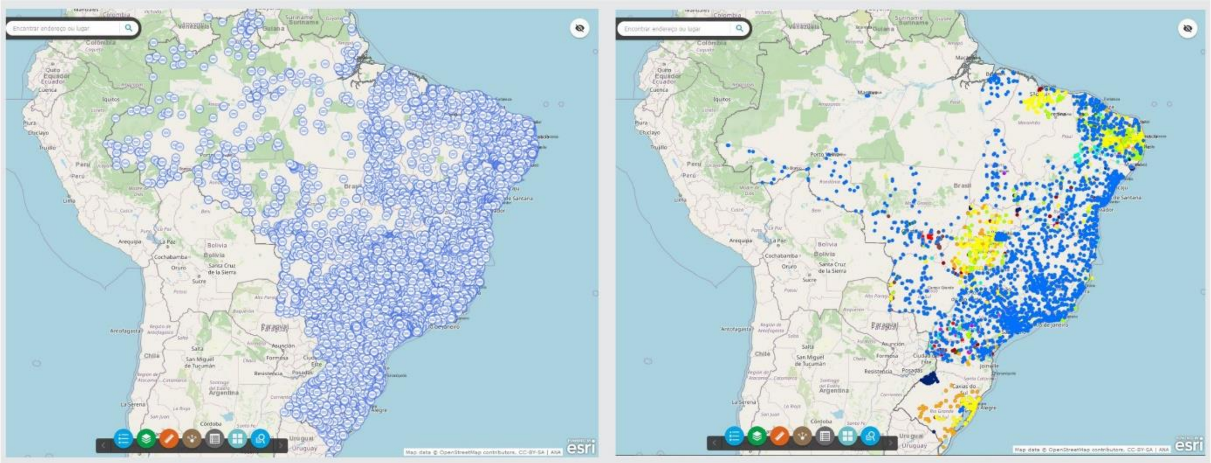


Figure 6 - The networks of flow measurement stations (left) and water quality control stations (right). Source: ANA/SNIRH

2.7. FLOW MONITORING AND DATA PUBLICATION

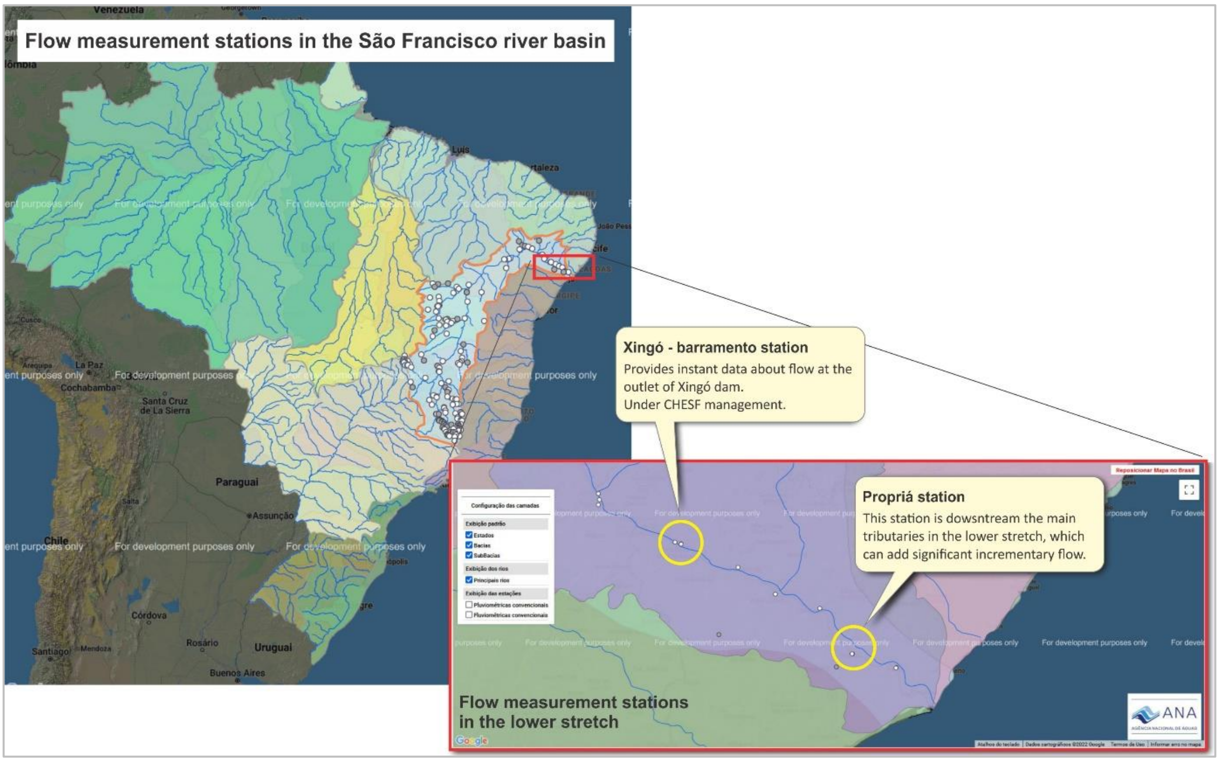
Almost all important rivers in Brazil have flow monitoring through a network under the water agency control. Data in telemetric or manual stations are provided by the agency and third-party sources. Flow monitoring statins in power generating dams are, generaly, controled by the electrical sector.

It is possible to obtain almost instantaneous flow data through the ANA hydro-telemetry website (in specific dam/strategic stations).

2.8. WATER QUALITY MONITORING AND DATA PUBLICATION

The water agency has a national monitoring network with data provided by its own systems and/or third-party sources. Each station has free data access but there is a serious data update problem.

There is no system for monitoring the quality of water that is consumed in natura for water abstractions from the diffuse population along the river.



Flow measurement stations in the São Francisco river basin

Xingó - barramento station
Provides instant data about flow at the outlet of Xingó dam.
Under CHESF management.

Propriá station
This station is dowsntream the main tributaries in the lower stretch, which can add significant incremental flow.

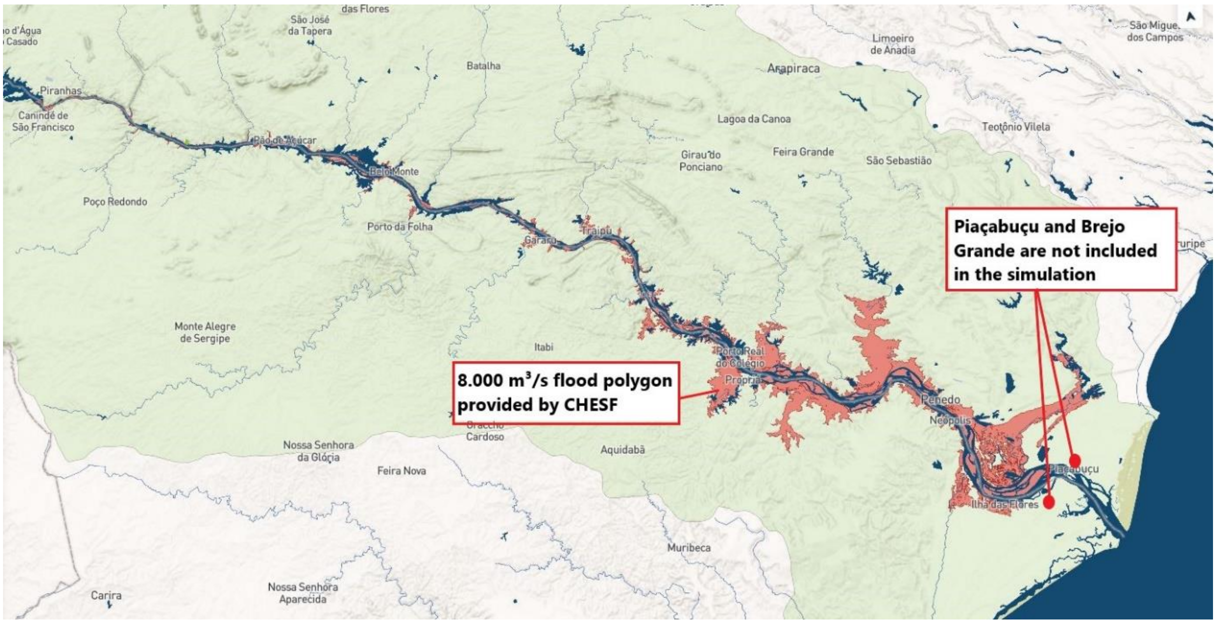
Flow measurement stations in the lower stretch

Figure 1 - Flow measurement stations in the São Francisco river basin and in the lower stretch. Source: ANA/SNIRH

2.9. INADEQUATED FLOOD PREVENTION

In rivers that use energy generation, it is up to the electricity sector (by regulation) to control floods through the operations of dams and reservoirs.

In 2016 CHESF, the São Francisco electric company produced a study where it presented simulations of (very specific) flooding zones for maximum flows of 8.000 m^3/s (which is the highest flow allowed by the regulatory system). Despite past event situations with much higher flows already recorded and the meteorological variations resulting from the climate crisis, studies of situations of extreme events are not known.


8.000 m³/s flood polygon provided by CHESF

Piaçabuçu and Brejo Grande are not included in the simulation

Figure 2 - The most "extreme" simulation, not public, of a 8.000 m³/s flood in BSF. Source: CHESF. Map: InfoSãoFrancisco

The study for [flood prevention] can be understood as incomplete and precarious, because in addition to being optimistic - in the midst of the climate crisis - for not considering situations above the restriction maximum flow, it focuses only in five locations (in zone of more than 1.000 km²) it also ignores the large diffuse population along the banks and does not accurately present the polygonal of the area of flooding. Essential information for the elaboration of any emergency plan.

The only known (but never published) polygons produced by the project by CHESF, relating to flows of 6,000 and 8,000 were obtained by Canoa de Tolda through a federal information access system that obliges public bodies to provide information and data.

The polygons also have the problem of omitting the flooding areas in the last two cities of Baixo São Francisco, Piaçabuçu, in Alagoas and Brejo Grande in Sergipe, which are just a few meters above the sea and already face problems with the retreat of the coastline.

3. OUR AREA OF INTEREST: THE LOWER STRETCH OF THE SÃO FRANCISCO RIVER

Our interest region is the **Baixo São Francisco** or **BSF**, **the lower stretch of the river**, more specifically dowstream the Xingó dam, about 200 km from the mouth.

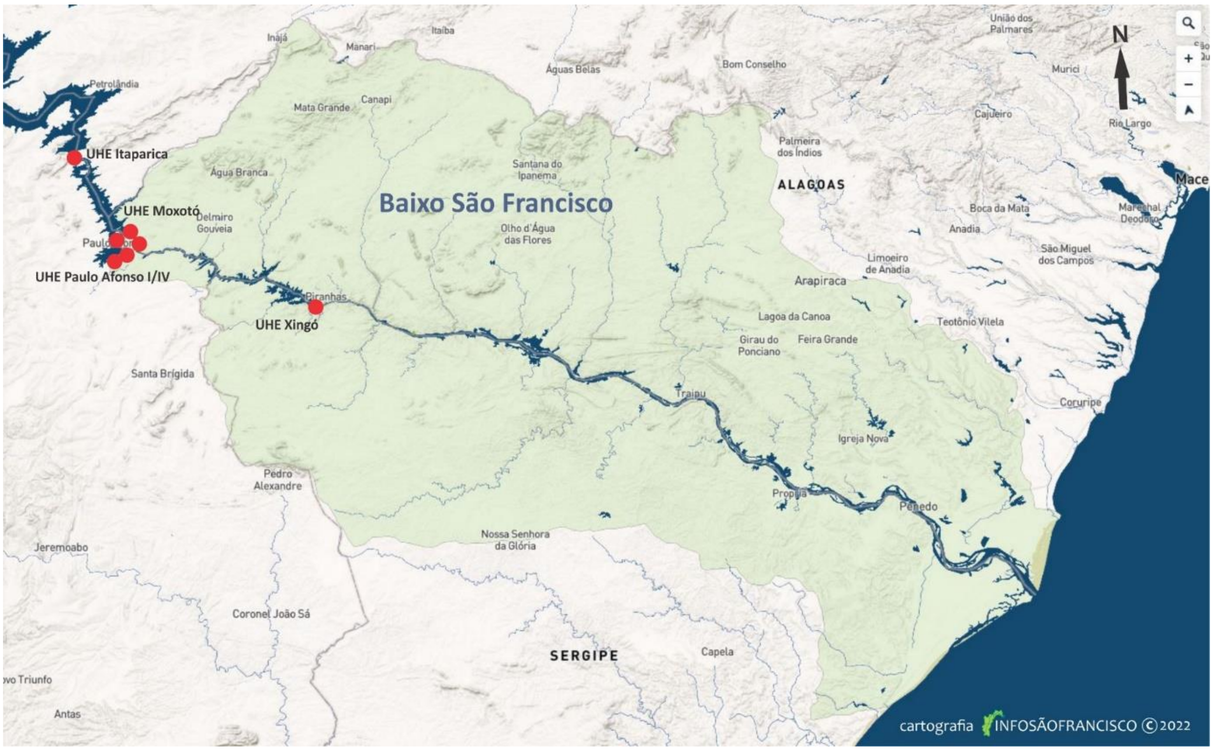


Figure 9 - The Baixo São Francisco, the lower stretch (and the most impacted one) of the great river. Source: ANA/CHESF

In this region, the activities of any project will be related to the states of Alagoas (left bank) and Sergipe (right bank).

Alagoas and Sergipe zones in the São Francisco river basin are totally located in the lower stretch, where the river meets the ocean at Piaçabuçu (Alagoas) and Brejo Grande (Sergipe).

Alagoas has 50 (fifty) municipalities in the São Francisco Basin, 11 (onze) on the river banks.

Sergipe has 28 (twenty-eight) municipalities that belong to the Basin and, of these, 11 (eleven) municipalities on the banks of the river.

Alagoas and Sergipe, are the states where the river is most impacted, by all human interference, as dams, irrigation, water polution, low flows and discharges of effluents in the Upper, Middle and Sub-medium stretches, leaving all the liabilities for this stretch.

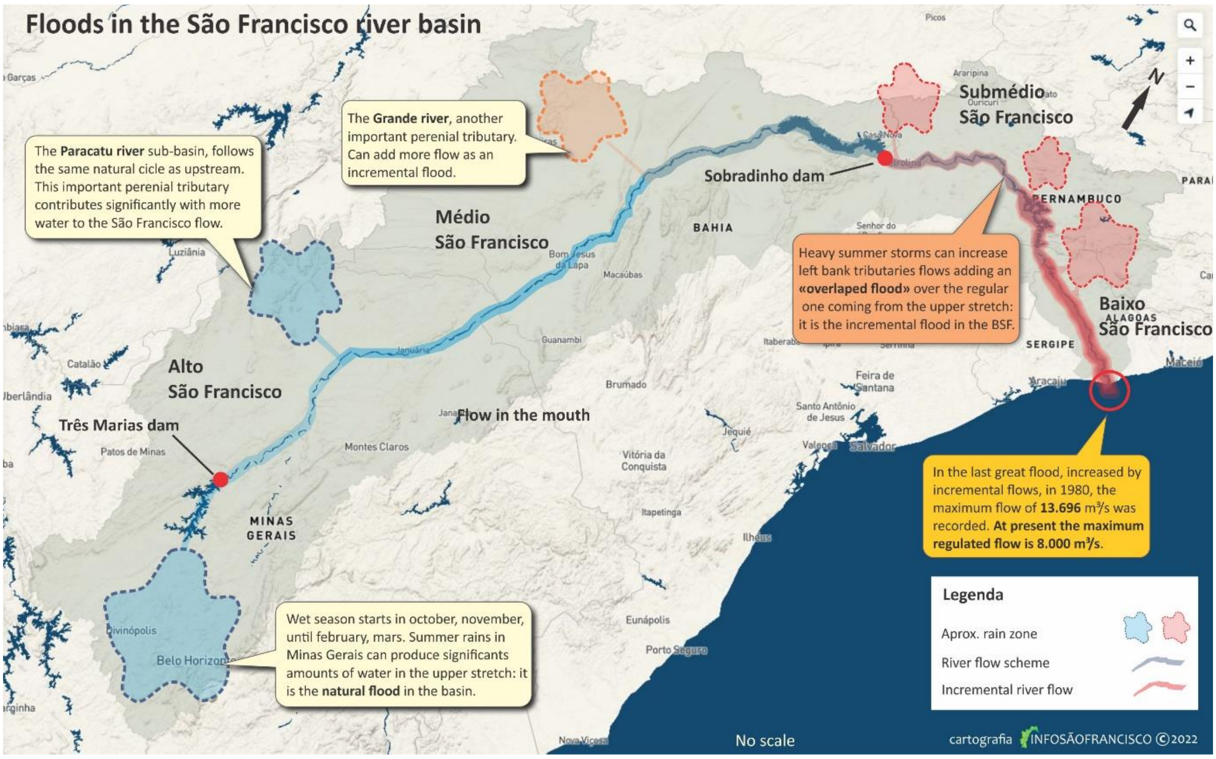
3.1. FLOODS AND LOCAL PERCEPTION: ABUNDANCE, LANDSCAPE, RENEWAL

The São Francisco basin is subject to two possible situation floods:

a) general floods, from the increase in flows in the upper São Francisco (where the main perennial tributaries are located, in the states of Minas Gerais and Bahia), which affects the entire main channel in all physiographic regions;

b) Incremental floods, generally in summers with torrential rains in the sub-medium São Francisco, affecting, in addition to this region, the Lower stretch;

However, it is still possible for a **general flood situation to occur simultaneously with an incremental flood** as in the item **b** above, creating a more complex situation for the entire lower stretch.


Floods in the São Francisco river basin

The **Paracatu river** sub-basin, follows the same natural cicle as upstream. This important perenial tributary contributes significantly with more water to the São Francisco flow.

The **Grande river**, another important perenial tributary. Can add more flow as an incremental flood.

Heavy summer storms can increase left bank tributaries flows adding an **«overlaped flood»** over the regular one coming from the upper stretch: it is the incremental flood in the BSF.

In the last great flood, increased by incremental flows, in 1980, the maximum flow of **13.696** m^3/s was recorded. **At present the maximum regulated flow is 8.000** m^3/s**.**

Wet season starts in october, november, until february, mars. Summer rains in Minas Gerais can produce significants amounts of water in the upper stretch: it is the **natural flood** in the basin.

Figura 10 - Source: ANA

Important: for the populations that lived on the banks [**before the dams**] and in tune with the natural cycle of the river, the floods were not a disaster. A good flood, filling the marginal lakes and floodplains, produced more fish, food as the rice, corn and beans plantations were benefited by the fertile humus left by the waters.

The floods were also part of the affective, cultural landscape of the riverside populations and provided moments of contemplation and well-being.

With the disappearance of people who lived on the river before and after the large dams (without the transmission of this memory), the perception of the quantity of water of the younger generations is disconnected from **river natural behavior before** the dams.

3.2. DAMS, FLOW REGULARIZATION, END OF NATURAL CYCLES, END OF FLOODS

With the construction of the Sobradinho dam, which imposed a regular flow of 2.060 m^3/s, the natural river cicles were eliminated.

The marginal lakes and floodplains received less and less water, until they became even more intermitent, dry and vulnerable to irregular occupations and uses.

Official impact "mitigation" projects, with the creation of irrigated perimeters, have never been able to reproduce the results of the river's natural cycles: today are failed areas of development that never took place. The region currently has very low human development indices, despite being close to the capitals of Alagoas and Sergipe.

3.3. CONFLICTS

Dams construction, concentrated use, water control, disorder of uses and occupation of territory: some of the ingredients for a menu of deep-rooted conflicts. With the construction of the dams, the fight for the indispensable water was installed forty two years ago.

Water management, as controlled by the electricity sector in harmony with agribusiness, is totally focused on "meeting the demand", when the available water, in a completely degraded basin, is not enough for the unsustainable and predatorymodel of use of the natural heritage.

Conflicts over water use are not recent, however, with inadequate public policies and the effects of the climate crisis as driving agents, there are increasingly confrontations throughout the basin, particularly in the semi-arid regions [**about 50% of the São Francisco basin is in the semi-arid polygon**] and in the lower stretch of the river.

Since the beginning of 2013, a minimum flow regime has been imposed on the lower stretch of the São Francisco river by the electricity sector due to the water crisis. Until 2012 the river flowed with 2,060 cubic meters per second, having reached an unthinkable flow of 550 m^3/s in 2017.

With the basin committee **suppressing the minimum flow of 1,300 m^3/s from the management plan**, today the minimum authorized flow is 700 m^3/s, about a third of the regularized flow established in 1979.

The portion of water "left over" for the aquatic and riparian ecosystems, in addition to the population of Baixo São Francisco, is in insufficient quantity and today, according to official data from the Federal University of Alagoas, it has serious quality and contamination problems.

3.4. SILTED RIVER, NO BUFFER VOLUME

Without ever having had dam operations with flows aimed at environmental service, the BSF has been suffering an intense process of marginal erosion and silting.

Naturally, the process is boosted by the conservation of riparian forests not only in the main channel but also in the tributaries, which are the target of great environmental degradation.

Thus, the current river channel, extremely silted up, does not hold, as it did years ago, the same volume of water from floods that may occur.

This condition means a completely different dynamics of flooding and occupation of the marginal lakes, floodplains and floodplains, creating situations of much greater risks than when the river was not yet dammed.

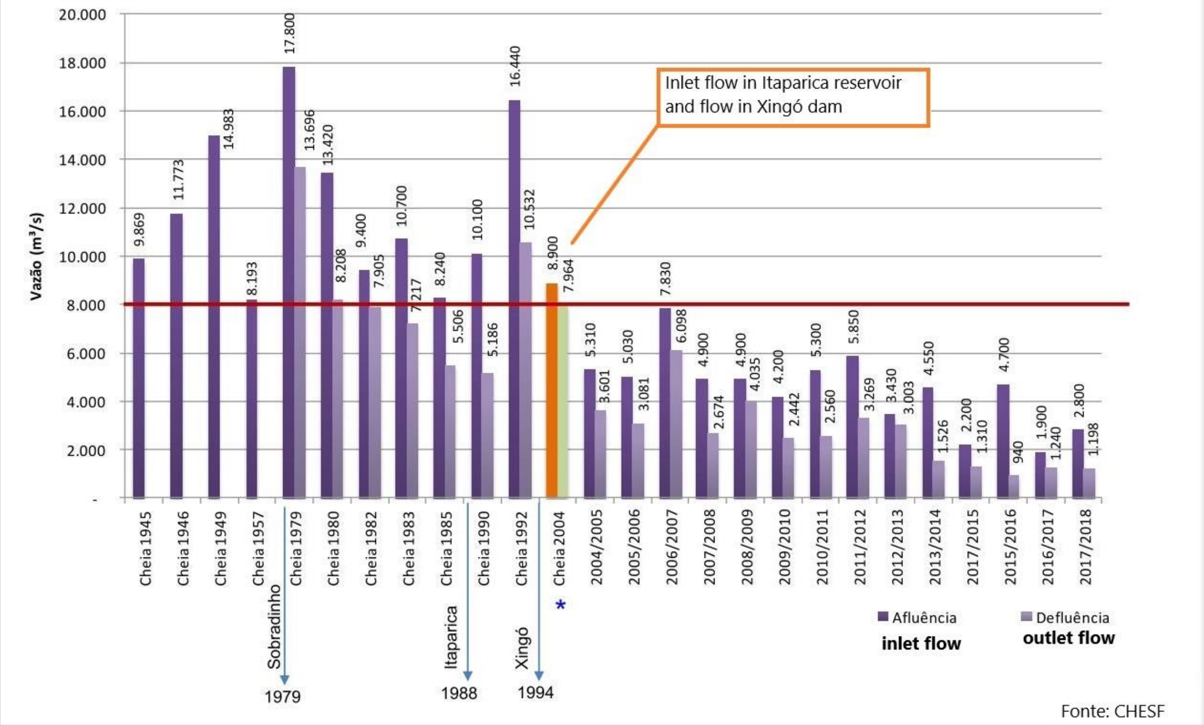
Objectively,the lower stretch of the São Francisco does not have adequate damping volume for large-scale floods.

3.5. THE LAST GREAT FLOODS X HIGHER RISKS UNDER A INTENSE CLIMATE CRISIS

At present, with the hegemonic use of water guaranteed and consolidated by a set of rules and regulations, is the electrical sector who establishes **Flood Situation and [dam] Flood Control Operations Rules** where the goal is to **control the flood, but maintaining the *water security*** for power generation.

However, despite the control of the waters, since 1980 there have been situations of particular events with large floods in a scenario without any preparationn or adequate responses: the impacts on unprotected populations were great.

Situation that even now, more than forty years after the construction of the first major regulatory dam remain the same.



Fonte: CHESF

Figure 3 - Floods (1945/2018) with incoming flow (in Sobradinho reservoir), and exit flow (Sobradinho dam).

As many official studies have already established that the São Francisco River basin is already suffering the effects of the intense climate crisis, in the lower stretch we have human populations living under the eventuality of extreme situations (drought or intense rain), punctual, creating the possibility of extreme events with a large impact.

3.6. RIVERBED, MARGINAL LAKES AND FLOODPLAINS [IRREGULAR, DANGEROUS] OCUPATIONS

With the gradual reduction of flows in the stretch, and with the great reduction since 2013, without inspection and control on the part of municipalities, states and the Union, irregular occupations occurred and still occur in the marginal lakes, in the floodplains and even in the dry riverbed.

Theare are many kind of occupations, such as residences, shops, public service structures (such as electricity and water networks, streets, roads) that are consolidated without any control.

3.7. (NO INFORMATION, NO MAPS) EMERGENCY PLANS: POPULATIONS UNDER VULNERABILITY

The federal government, the states of Alagoas and Sergipe and the municipalities in the region have no emergency plan in place in the event of a major flood.

When asked through legal systems of mandatory collection of information, both states of Alagoas and Sergipe authorities mention that the water federal agency would be responsible “for the management of water resources in the aforementioned hydrographic basin, including the dissemination of information”.

The civil defense authority of the states, the state agency for managing environmental crises and accidents, when questioned, says that it is up to the civil defenses in the municipalities to prepare emergency plans for such cases.

The most profound and reckless lack of vision and integrated planning is observed for a problem that is not isolated to each municipality (that do not have the structure or resources for such initiatives and actions) and that, for different reasons, is not included as a high priority in regional public policies.

Through formal demands to state and federal public agencies, the presentation of accurate maps with marginal lakes, floodplains and and the polygons of the flooded area according to extreme flows (considering historical ones and worse scenarios) and irregular occupations was requested. No body was able to present any documents.

Without such information, any supposed emergency plan for extreme flood events, which must, under any circumstances, be integrated for the entire region, will not have the slightest chance of success and of adequately safeguarding human lives.

Without an emergency plan and without planning and control of land uses and occupations, the expansion of risk situations in marginal lakes, floodplains and in the exposed river bed continues to progress, since inspection bodies (municipal, state or federal) do not fulfill their functions.

Finally, the so-called **Flood Control Operation Rules** elaborated by the electric sector, concern only the operations of the reservoirs without considering human populations and the environment.

4. MOST SIGNIFICANT AND PRIORITIZED TARGET PROBLEMS – AMONG MANY…

The recent situations of disasters caused by heavy rains in regions with serious problems of uses and occupations of risk, as in the states of Bahia, Minas Gerais and Rio de Janeiro, prove the lack of prioritization and preparation of the public power for events that could become more and more frequent - due to the climate crisis - to even more devastating.

Without an **Emergency and Preventive Preparation** plan duly prepared and adopted for a possible flood situation of great magnitude in the region, there is a considerable part of the riverside population downstream of the Xingó dam no Baixo that remains, therefore, at risk situations of different magnitudes.

In the specific case of BSF, our region of interest, the goal was established to map the entire population in risk zones in a range of extreme flows in order to provide - to the public authorities - information that makes it possible, in fact, to elaborate of an Integrated Preventive and Emergency Plan for situations of major floods.

With limitations in human, physical and financial resources, the initiative was divided into three stages:

- **The first step**, to get to the mapping of the people, would be the mapping of lagoons and intermittent marginal floodplains throughout the BSF.

- **The second one**, construction of the flood areas polygons above 8.000 m³/s.

- **The third one**, mapping people in risk zones.

5. WHAT DO WE HAVE AT PRESENT? WHAT IS UNDER WAY…

5.1. COOPERATIONS, MAPPING PROJECTS

As mapping the territory projects are the main objective, our first step was seeking training and improving our skills for the assembly of a technical base that would produce consistent initiatives.

Along these lines, in November 2021, cooperation was established with **HOT - Humanitarian OpenStreetMap Team** and **UFAL** (federal university of Alagoas) creating the project MapSãoFrancisco which will manage the mapping projects, initially to the lower stretch of the São Francisco River.

In january 2022 conversations started with **Open Skies Fellows**, **Deltares**, which has many has excellent projects in Tanzania related to citizen management of territory and water, with a focus on empowering people through training and transfer of open, free technologies. OpenSkyes projects targets situations very similar to those faced by populations in the BSF.

5.1.1. STEP 1 - MAPPING INTERMITENT MARGINAL LAKES AND FLOODPLAINS

What do marginal lakes have to do with populations in risk zones? Everything.

The intermitent marginal lakes of the lower São Francisco which, since the construction of the Sobradinho dam (1979/80), have never been filled again, promoting the brutal loss of biodiversity (they were the natural nursery of the ichthyofauna) and a situation of food insecurity (it was a place of subsistence agricultural activities in the periods of ebb after the river floods).

Under the regularization of the river, the lakes disappeared from the official cartography, preventing public policies for environmental recovery and discussion of dam operation models that contemplate their filling.

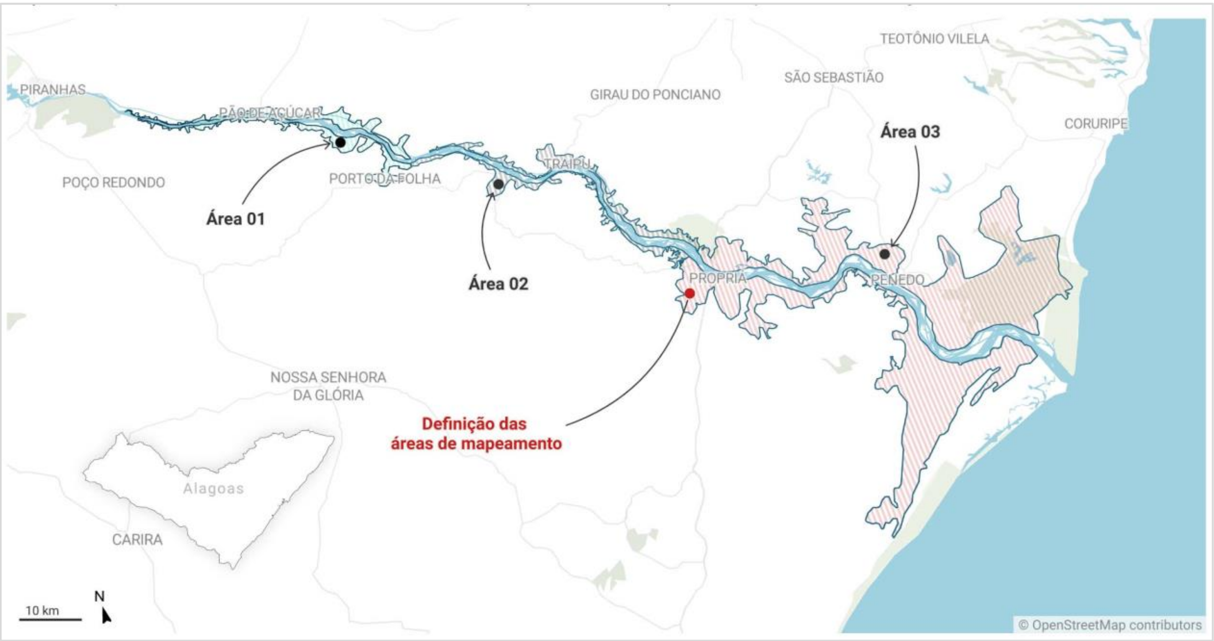
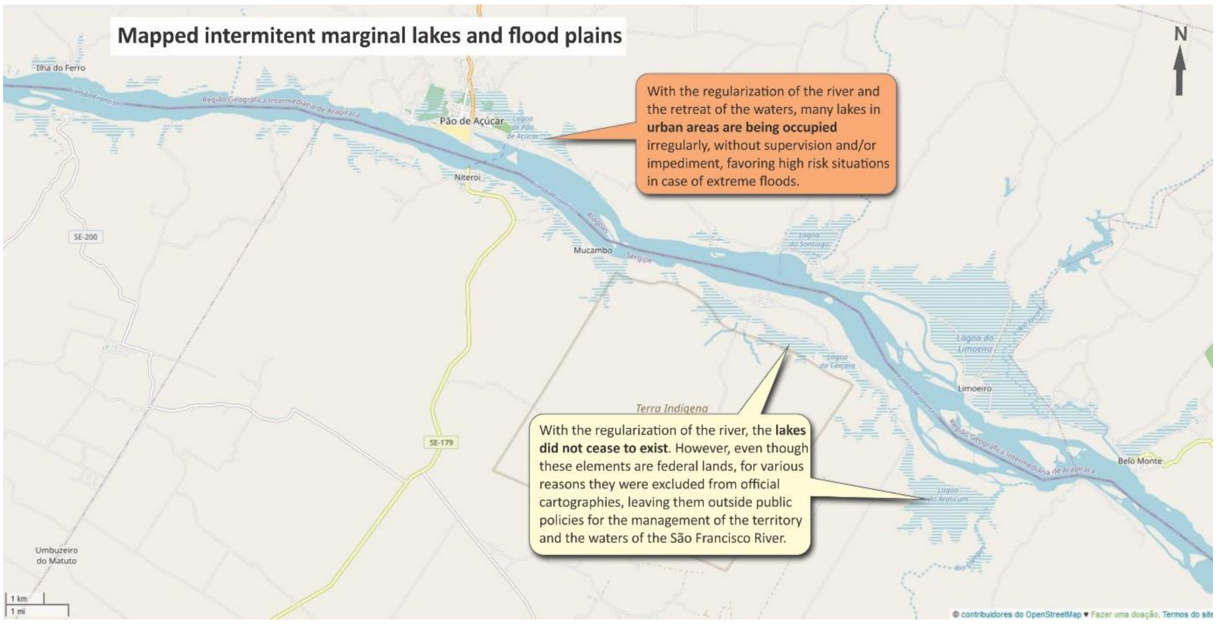


Figure 4 - The intermitent marginal lakes and floodplains mapping project area. Map: InfoSãoFrancisco/MapSãoFrancisco

The marginal lagoons are federal public areas, but they are being irregularly and illegally occupied. Such water bodies are a physical part of the flooding process of the river's floodplain and must be preserved not only for environmental reasons, but also for the safety of human lives.



Mapped intermitent marginal lakes and flood plains

With the regularization of the river and the retreat of the waters, many lakes in **urban areas are being occupied** irregularly, without supervision and/or impediment, favoring high risk situations in case of extreme floods.

With the regularization of the river, the **lakes did not cease to exist**. However, even though these elements are federal lands, for various reasons they were excluded from official cartographies, leaving them outside public policies for the management of the territory and the waters of the São Francisco River.

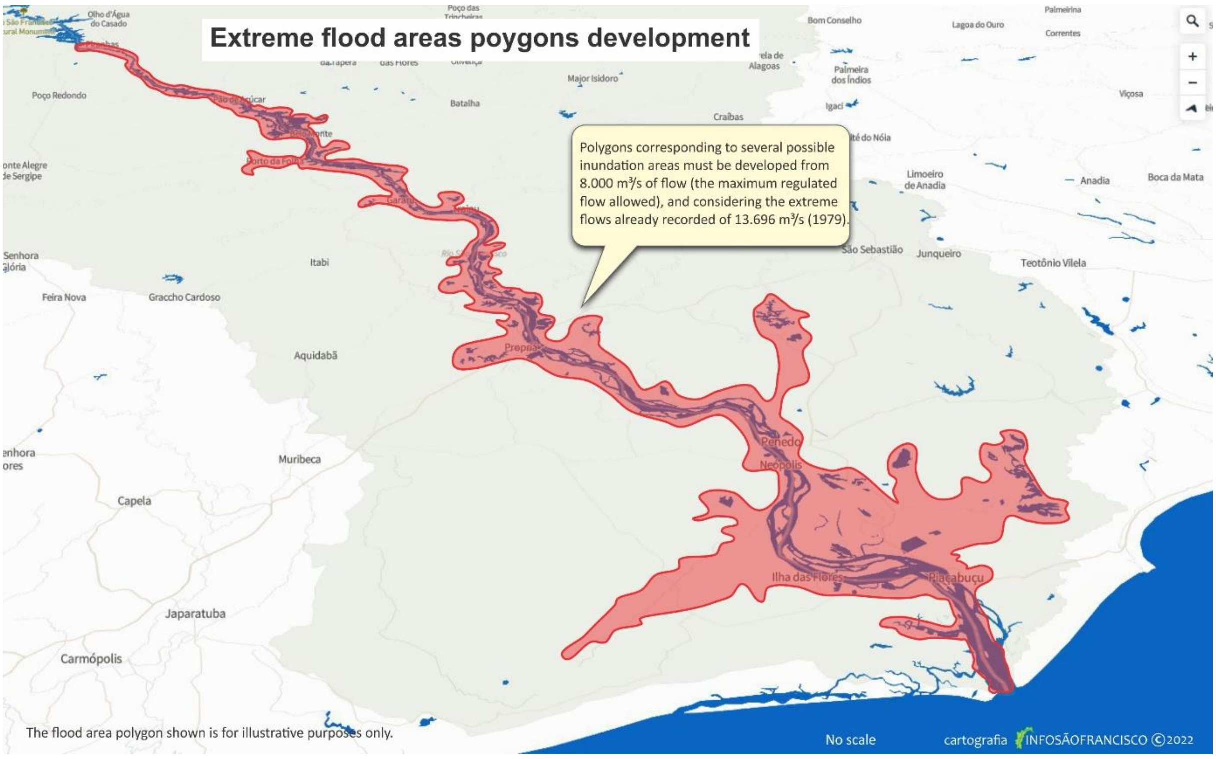
Figure 5 - Intermitent marginal lakes and flood plains. Source: HOT/OpenStreetMap

With the training provided by HOT, MapSãoFrancisco launched the project to map intermittent lagoons and floodplains using the HOT Tasking Manager system, which by the end of February 2022 was well advanced, with its first stage (Area 01 of three) completed.

5.1.2. STEP 2 – FLOOD AREAS POLYGONS DESIGN

There is no information on what the flooded areas in the BSF will actually look like in the event of major floods. The available data are precarious, incompletely simulating floods up to a maximum flow of 8,000 m³/s. It is necessary to know the framework of extreme situations considering floods that have already occurred and the component of the climate crisis.

With the evolution of the conversations with OpenSkies and Deltares, at the end of January 2022, it was agreed to obtain data on historical flows in the BSF and digital models of the terrain, in order to allow the elaboration of the polygonal of the flooded areas.


Extreme flood areas poygons development

Polygons corresponding to several possible inundation areas must be developed from 8.000 m³/s of flow (the maximum regulated flow allowed), and considering the extreme flows already recorded of 13.696 m³/s (1979).

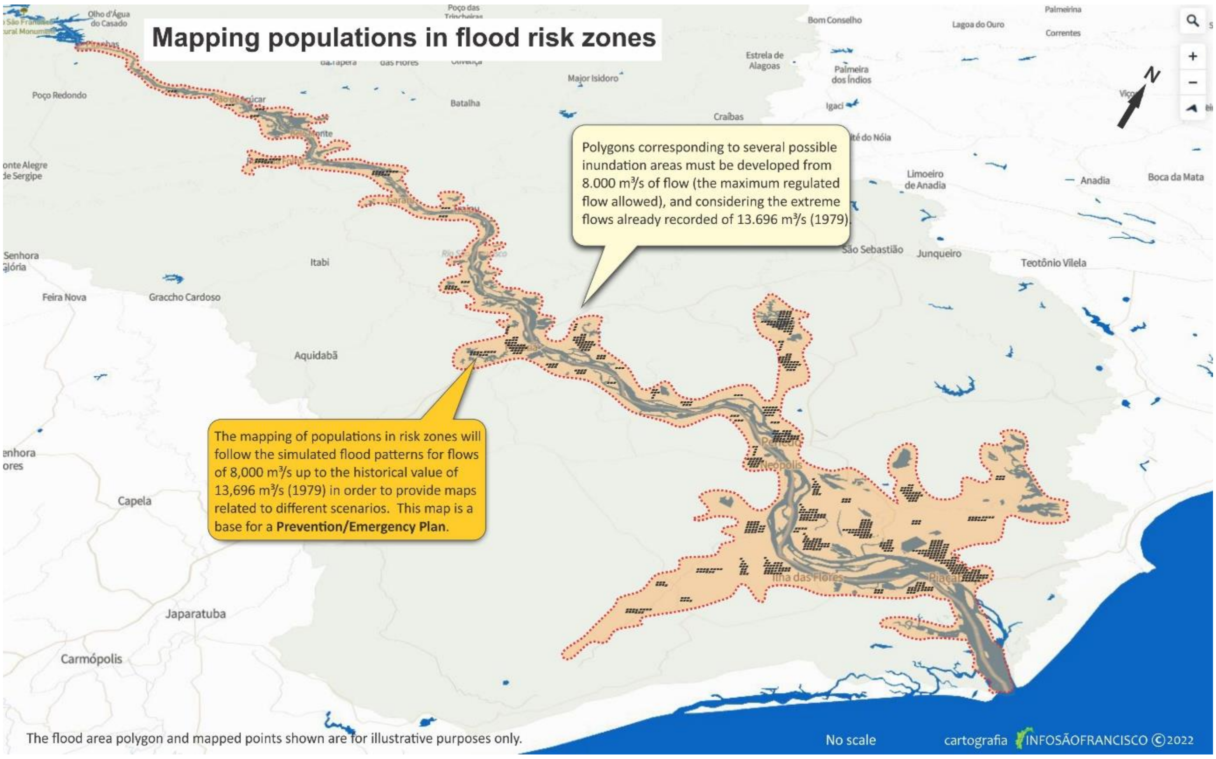
The flood area polygon shown is for illustrative purposes only.

No scale

cartografia INFOSÃOFRANCISCO ©2022

Figure 6 - Source: MapSãoFrancisco

5.1.3. STEP 3 - MAPPING PEOPLE IN RISK ZONES INSIDE FLOODING AREAS


Mapping populations in flood risk zones

Polygons corresponding to several possible inundation areas must be developed from 8.000 m³/s of flow (the maximum regulated flow allowed), and considering the extreme flows already recorded of 13.696 m³/s (1979).

The mapping of populations in risk zones will follow the simulated flood patterns for flows of 8,000 m³/s up to the historical value of 13,696 m³/s (1979) in order to provide maps related to different scenarios. This map is a base for a **Prevention/Emergency Plan**.

The flood area polygon and mapped points shown are for illustrative purposes only.

No scale

cartografia INFOSÃOFRANCISCO ©2022

Figure 7 - Source: MapSãoFrancisco

Map the population in the high risk flood area for the case of an extreme event (from 8.000 m^3/s up to 13.000 m^3/s).

Having in hand the polygons of the flooding areas, it will be possible to create a new project by MapSãoFrancisco (with the HOT Tasking Manager system) which will have as its object the challenge of mapping the entire population of BSF in risk zones.

The result will be public, of course, and will enable civil society to demand, on the part of the public authorities, for the adoption of measures that produce a Plan for Prevention and Emergency Actions in the Case of Large Floods.

5.2. IF YOU THINK YOUR PARTICIPATION WOULD HELP TO IMPROVE THIS COLECTIVE EFFORT…

Are the problem, proposed activities and possible solutions within your possibilities?

Do you have the technical knowledge, skills, willingness to fight injustices against diverse human populations, face the climate crisis and time available?

Fell wellcome and make contact at canoadetolda@canoadetolda.org.br .

The last piabas (*Astyanax bimaculatus*)?. Foto: Carlos E. Ribeiro Jr./InfoSãoFrancisco

6. REFERENCES, USEFUL LINKS AND ACCESS

ANA - https://www.gov.br/ana/pt-br

SNIRH ( ) - http://www.snirh.gov.br/

Hidro Telemetria (flow monitoring telemetric stations) - http://www.snirh.gov.br/hidrotelemetria/Mapa.aspx

Reservoirs monitoring - https://www.ana.gov.br/sar/

Hidro Web (historical series of flows) - http://www.snirh.gov.br/hidroweb/serieshistoricas

Sala São Francisco (São Francisco daily hydrological informations) - https://www.gov.br/ana/pt-br/sala-de-situacao/sao-francisco

RNQA (national network for water quality) **–**

Stations map - http://portal1.snirh.gov.br/ana/apps/webappviewer/index.html?id=e745db7488f64e1a9a2e4e150e41b08e

Data/downloads - https://dadosabertos.ana.gov.br/datasets/fa80c71fdd8f4e1e8f86424f72b3bc52_1/explore?location=-13.647650%2C-39.984176%2C8.38

Canoa de Tolda - https://canoadetolda.org.br/

Data/documents - https://archive.org/details/@canoa_de_tolda

Data/documents – https://issuu.com/canoadocs

Data/documents - https://issuu.com/canoadetolda

CBHSF - https://cbhsaofrancisco.org.br/

Data - https://siga.cbhsaofrancisco.org.br/sfmap/

CEMIG (Três Marias dam**)** - https://www.cemig.com.br/usina/tres-marias/

CHESF - https://www.chesf.gov.br/Pages/default.aspx

Dams informations - https://www.chesf.gov.br/SistemaChesf/Pages/SistemaGeracao/Xingo.aspx

Dams data - https://www.chesf.gov.br/SistemaChesf/Pages/GestaoRecursosHidricos/GestaoRecursosHidricos.aspx

BSF mapping project - https://www.chesf.gov.br/SistemaChesf/Pages/GestaoRecursosHidricos/Mapeamento%20-%20Baixo%20S%C3%A3o%20Francisco.aspx

CPRM – http://siagasweb.cprm.gov.br/layout/visualizar_mapa.php

Deltares – https://www.deltares.nl/nl/

HOT – Humanitarian OpenStreetMap Team - https://www.hotosm.org/

HOT Tasking Manager - https://tasks.hotosm.org/

IBAMA (environmental licensing process**) -** http://www.ibama.gov.br/laf/procedimentos-servicos/etapas-do-licenciamento-ambiental-federal

InfoSãoFrancisco – https://infosaofrancisco.canoadetolda.org.br/

MapSãoFrancisco - https://canoadetolda.org.br/iniciativas/projetos-permanentes/mapsaofrancisco/

ONS (data dowload center**)** – http://www.ons.org.br/paginas/resultados-da-operacao/historico-da-operacao

OpenSkies Fellows – https://openskiesfellows.org/

UFAL - https://arapiraca.ufal.br/graduacao/engenharia-de-pesca/institucional/laboratorios/laboratorio-de-estudo-da-pesca-labpesca

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Update – feb 28th/2022

Cover: The Baixo São Francisco | Carlos E. Ribeiro Jr's Illustration for for the documentary "Na Veia do Rio" – 2000 by Ana Rieper. Production: Canoa de Tolda/Paladina Filmes